PROJECT FINAL REPORT

Ipswich River Watershed BMP Implementation at Farley Brook
Project No. 14-06/319

2014-2017

GRANTEE:
Town of Ipswich, Massachusetts
Richard Clarke
Director of Public Works

Malcolm Harper
MassDEP Project Manager

PREPARED FOR:

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER RESOURCES

AND

US ENVIRONMENTAL PROTECTION AGENCY
REGION 1

MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
Matthew A. Beaton, Secretary

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Martin Suuberg, Commissioner

BUREAU OF WATER RESOURCES
Douglas Fine, Assistant Commissioner

DIVISION OF MUNICIPAL SERVICES
Steven J. McCurdy, Director

A. Project Snapshot

Ipswich River Watershed BMP Implementation at Farley Brook
Project No. 14-06/319

A1. Project Start Date: July 15, 2014
A2. Date Closed: June 30, 2017
A3. Ipswich River Watershed, HUC -12: 010900010205, Sub-basin: Ipswich, Sub-basin ID: 17076
A4. Segment: MA92-02
A5. Status of waterbody: Category 5 - Waters requiring a TMDL
A6. Priority Pollutant(s) targeted: Pathogens, Phosphorus, and Sediment

Farley Brook discharges directly to the Ipswich River and has been identified as a contributor of pollutants to the Ipswich River through past studies. This project was initiated as a continuation of past studies with the objective of improving the water quality in Farley Brook to reduce the impacts to the Ipswich River. Based on past study recommendations and additional investigations completed in combination with this project, a location was identified within limited available land space and an engineered wetland BMP was designed and permitted for construction within the location. The designed BMP provided the benefits of flood mitigation within an open section of Farley Brook, while also providing the opportunity for pollutant removal under typical flow events.

A7. BMP Pollutant Load Calculations

Since pathogens are the more difficult constituent to address, the calculations below focus on the projected treatment removal for that pollutant.

The Simple Method – Pollutant Load Calculations (NH Stormwater Manual: Vol. 1)

Calculations for Bacteria

L = 1.03*(10^-3)*R*C*A

Where:

L=Annual load (Billions Colonies/yr)
R=Annual runoff (inches)
C=Bacteria concentrations (col/100ml)
A=Area (acres)

Calculations for Annual Runoff

The Simple Method calculates annual runoff as a product of annual runoff volume and a runoff coefficient (Rv). Runoff volume is calculated as:

R = P*Pj*Rv

Where:

R=Annual runoff (inches)
P=Annual rainfall (inches)
Pj=Fraction of annual rainfall events that produce runoff (usually 0.9)
Rv=Runoff coefficient

Calculation for Runoff Coefficient

In the Simple Method, the runoff coefficient is calculated based on impervious cover in the subwatershed. This relationship is shown in Figure 8-1 of the New Hampshire Stormwater Manual Volume 1.

Rv = 0.05 + 0.9Ia

Where:

Rv = Runoff coefficient
I a = Percent impervious area draining to the structure in decimal form.

Assuming Ia = 0.7; P = 47.4 (NOAA for Beverly, MA); C = 7,000; A = 104Rv = 0.68; yields

Rv (Runoff coefficient)	**R (inches)**	**L (Billions Colonies/yr)**
0.68	29.00	21,745

Assuming a 75% pollutant removal efficiency (Massachusetts Stormwater Handbook Vol. 2) yields a projected annual removal of (21,745 x .75) 16,308 billion colonies/year.

A8. BMPs installed, number and type:

The project design included a single engineered wetland area to provide flood mitigation and treatment for the target pollutants under typical flow scenarios.

B. Descriptive Project Summary

PROJECT TITLE: **Ipswich River Watershed BMP Implementation at Farley Brook**
NPS CATEGORY:
INVESTIGATOR: **Town of Ipswich**
LOCATION: **Ipswich River Watershed**
TARGETED POLLUTANTS: Pathogens, Phosphorus, and Sediment

Project Overview: Farley Brook is both an open and underground piped waterway that collects stormwater runoff from the downtown area of Ipswich and discharges to the segment of the Ipswich River designated as MA92-02. This segment is described as follows: Ipswich Dam (formerly known as Sylvania Dam), Ipswich to mouth at Ipswich Bay, Ipswich. This segment of the Ipswich River is listed as a Category 5 with an identified impairment for fecal coliform in the MassDEP 2014 Integrated List of Waters. Runoff contributes flow to Farley Brook as a combination of surface water flow and point source discharges (municipal stormwater outfalls, roof leaders and sump pump discharges) in the upper open portion, and exclusively as point source discharge in the underground enclosed section.

The intent of the project has been to address the identified presence of pathogens, phosphorus and sediment within Farley Brook. Numerous studies have been completed and reports prepared that document the impaired water quality within Farley Brook and the impact that the discharge from this waterway has on the Ipswich River and the coastal area of Ipswich. These studies have been performed over a period of years and include segmented sampling of the brook to attempt to identify sources of the pollutants. A summary of the monitoring results is depicted on the attached Figure 1.

In addition to the past investigations of water quality, "sniffing dogs" were employed during this project both within the stream bed as well as within the Farey Brook catchment area in an attempt to isolate specific sources of bacteria entering Farey Brook. The sniffing dogs have been trained to identify the presence of human waste in collected water samples as well as directly from within streams, catchbasins, manholes, etc. Since properties within the Farley Brook watershed have been connected to the Town's sanitary sewer system, the obvious potential source of failed septic systems or direct discharges of sanitary waste from properties appear to have been eliminated. However, since elevated pathogen levels continue to be detected intermittently within the brook, undetected sources remain. Although the sniffing dogs did not identify any specific direct sources, the results of their survey did indicate that pathogen contribution to Farley Brook was wider spread throughout the catchment than initially anticipated. The results of the study performed by the sniffing dogs is depicted with the monitoring results on Figure 1.

Both in-line treatment techniques as well as open best management practices (BMPs) were considered for implementation. However, when the monitoring results completed as part of this project were combined with the recommendations from past assessments of Farley Brook, it was determined that the most appropriate approach would be the design and implementation of an open system to control flooding and improve water quality.

The final system design includes an open engineered wetland within the limited available space at the entrance to the underground portion of Farley Brook. The system design assumes that during higher flow periods the flow from Farley Brook will enter the constructed wetland where it will temporarily

be retained to mitigate flooding at the inlet to the underground portion of the brook. Pollutant levels within the retained flow will be reduced through natural processes.

Project Objectives:
1. Modify Existing BMP Design
2. Obtain Permits
3. Project Bidding and Award
4. BMP Construction
5. System Performance Monitoring
6. Outreach and Training
7. Ipswich River Watershed Association Activities
8. Reporting

Methods: The Town of Ipswich and interested parties, including the Ipswich River Watershed Association (IRWA), have been performing organized monitoring and assessment of the Ipswich River and contributing waterbodies for decades. In 2000 a report entitled "Coastal Stormwater Remediation Plan for the Town of Ipswich" (Keane & Castonguay) identified Farley Brook as "the largest contributor of contaminated runoff to the coastal area of Ipswich" and a major contributor to the regular closure of the Town's multi-million dollar shellfishery following significant rain events. In addition to the 2000 report, a study specific to Farley brook was completed with the support of a 2007 Coastal Pollutant Remediation (CPR) Grant through the Massachusetts Division of Coastal Zone Management (CZM). This project included a targeted watershed survey and assessment and the results further verified that Farley Brook is impacted by specific contaminants, including fecal coliform and enterococcus (e. coli) bacteria, total petroleum hydrocarbons (TPH) and total suspended solids (TSS) and that these contaminants are directly impacting the Ipswich River.

The 2007 study provided conceptual-level recommendations for BMPs for consideration to address the detected pollutants within Farley Brook. The recommended BMPs included a series of both structural and non-structural BMPs focused primarily on improving the water quality within the open portion of Farley Brook, although structural BMPs were also recommended to collect and treat stormwater within the municipal stormwater system prior to it entering the underground lower section of Farley Brook.

The Town of Ipswich contracted with Coneco Engineers and Scientists, Inc. to continue the recommendations of prior studies and prepare design documents and complete permitting for the construction of an engineered wetland area within an identified undeveloped private property adjacent to Farley Brook. With significant interaction with DEP, draft final design plans (see Appendix A) were developed and permitting for the project was conditionally approved by the Conservation Commission. However, due to concerns expressed by local residents regarding the siting and details of the project, the Town elected to postpone its construction while further discussions are held. Therefore, results of system performance are not yet available.

PROJECT COST: $117,215.55

FUNDING: $70,016.66 by the US EPA
$47,198.89 by the Town of Ipswich and project participants

DURATION: 2014 – 2017

C. Project Finances

Original Project Budget
Ipswich River Watershed BMP Implementation at Farley Brook
14-06/319

Expense Items	s.319 Amount	Non-Federal Match and Source	Total Amount
Salaries, Fringe and Overhead (Town of Ipswich)			
DPW Director ($72/hr)		$39,000[1&2]	$39,000
DPW Operations Manager ($60/hr)		$77,200[1&2]	$77,200
Highway Foreman ($37/hr)			
Asst. Foreman ($35/hr)			
Operator/Laborer ($30-35/hr)			
Construction Equipment (est. $2,000/day)			
Subtotal	**$0**	**$116,200**	**$116,200**
Subcontractual Services			
Non-Structural and Structural BMP Redesign	$5,000	$16,200[1]	$21,200
Permitting	$5,000	$5,000[1]	$10,000
Bidding and Award	$0	$6,000[1]	$6,000
Structural BMP Construction (Construction Contractor)	251,000	$0	$251,000
Non-Structural BMP Construction	$0	$0	$0
Outreach and Training Program		$6,600	$6,600
IRWA Associated Activities (Costs provided by IRWA)	$0	$24,000[3]	$24,000
Reporting	$600	$3,300	$3,900
Subtotal	**$261,600**	**$61,100**	**$322,700**
Totals:	**$261,600**	**$177,300**	**$438,900**
Percent	**60%**	**40%**	**100%**

[1]Compensation from Town funds [2]Compensation from Town provided in-kind services [3]IRWA funding for watershed related projects

The Disadvantaged Business Enterprise, (DBE) Program "Fair Share" goals for the project are: $14,923 for D/MBE (3.4%) and for $16,678 D/WBE (3.8%). Firms utilized in Federally Assisted Projects must be certified as either an MBE or WBE *and* a DBE.

The Department will retain 10% of the total maximum obligation of the 319 grant funds or the final invoice submitted by the Grantee, whichever is greater, until all contract provisions are satisfied and final reports and other products are delivered and accepted. This 10% retainage shall be reflected on each invoice submitted by the Grantee and will be cumulative in the amount of $26,160 (10% of the contract amount.

Revised Project Budget
Ipswich River Watershed BMP Implementation at Farley Brook
14-06/319

Expense Items	s.319 Amount	Amendment	Non-Federal Match and Source	Total Amount
Salaries, Fringe and Overhead (Town of Ipswich)				
DPW Director ($72/hr)			$39,000[1&2]	$39,000
DPW Operations Manager ($60/hr)			$77,200[1&2]	$77,200
Highway Foreman ($37/hr)				
Asst. Foreman ($35/hr)				
Operator/Laborer ($30-35/hr)				
Construction Equipment (est. $2,000/day)				
Subtotal	**$0**	**$0**	**$116,200**	**$116,200**
Subcontractual Services				
Non-Structural and Structural BMP Redesign	$5,000	$25,000	$16,200[1]	$41,200
Permitting	$5,000	$15,000	$5,000[1]	$20,000
Bidding and Award	$0	$0	$6,000[1]	$6,000
Structural BMP Construction (Construction Contractor)	251,000	141,000	$0	$141,000
Non-Structural BMP Construction	$0	$80,000	$0	$80,000
Outreach and Training Program			$6,600	$6,600
IRWA Associated Activities (Costs provided by IRWA)	$0	$0	$24,000[3]	$24,000
Reporting	$600	$600	$3,300	$3,900
Subtotal	**$261,600**	**$261,600**	**$61,100**	**$322,700**
Totals:	**$261,600**	**$261,600**	**$177,300**	**$438,900**
Percent	**60%**	**60%**	**40%**	**100%**

[1]Compensation from Town funds [2]Compensation from Town provided in-kind services [3]IRWA funding for watershed related projects

The Disadvantaged Business Enterprise, (DBE) Program "Fair Share" goals for the project are: $14,923 for D/MBE (3.4%) and for $16,678 D/WBE (3.8%). Firms utilized in Federally Assisted Projects must be certified as either an MBE or WBE *and* a DBE.

The Department will retain 10% of the total maximum obligation of the 319 grant funds or the final invoice submitted by the Grantee, whichever is greater, until all contract provisions are satisfied and final reports and other products are delivered and accepted. This 10% retainage shall be reflected on each invoice submitted by the Grantee and will be cumulative in the amount of $26,160 (10% of the contract amount.

Amended 8/17/2016 to better reflect actual project costs. Approved M. Harper, 8/17/2016.

Final Project Budget
Ipswich River Watershed BMP Implementation at Farley Brook-Amendment #2
14-06/319

Expense Items	s.319 Amount	Non-Federal Match	Total Amount
Salaries, Fringe and Overhead (Town of Ipswich) [1]		**$33,698.89**	**$33,698.89**
DPW Director ($72/hr)			
DPW Operations Manager ($60/hr)			
Highway Foreman ($37/hr)			
Asst. Foreman ($35/hr)			
Operator/Laborer ($30-35/hr)			
Construction Equipment (est. $2,000/day)			
Subtotal		**$33,698.89**	**$33,698.89**
Subcontractual Services	**$70,016.66**		
Non-Structural and Structural BMP Redesign			
Permitting			
Bidding and Award			
Structural BMP Construction (Construction Contractor)			
Non-Structural BMP Construction			
Outreach and Training Program			
IRWA Associated Activities (Costs provided by IRWA) [2]		$7,000	$7,000
Reporting		$6,500	$3,900
Subtotal	**$70,016.66**	**$47,198.89**	**$117,215.55**
Totals:	**$70,016.66**	**$47,198.89**	**$117,215.55**
Percent	**60%**	**40%**	**100%**

[1]Compensation from Town funds [2]IRWA funding for watershed related projects

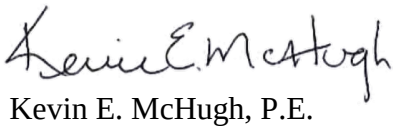
The Disadvantaged Business Enterprise, (DBE) Program "Fair Share" goals for the project are: $3,985 for D/MBE (3.4%) and for $4,454 D/WBE (3.8%). Firms utilized in Federally Assisted Projects must be certified as either an MBE or WBE *and* a DBE.

The Department will retain 10% of the total maximum obligation of the 319 grant funds or the final invoice submitted by the Grantee, whichever is greater, until all contract provisions are satisfied and final reports and other products are delivered and accepted. This 10% retainage shall be reflected on each invoice submitted by the Grantee and will be cumulative in the amount of $7,002 (10% of the contract amount.

Amended 11/22/2017 to better reflect final project costs. Approved M. Harper, 11/22/2017.

D. Description of BMPs.

D1. Type of BMP: Engineered Wetland
D2. Date of implementation: N/A
D3. Size of treatment area: 18,000 sqft (approx. as designed)
D4. Area land use: Undeveloped
D5. Pollutant load removed: Estimated to be up to 75% for pathogens and 85% for Total Suspended Solids per the Massachusetts Stormwater Handbook.
D6. Method of pollutant load removal determination and calculations: Simple Method per the New Hampshire Stormwater Manual, Volume 1 and the Massachusetts Stormwater Handbook, Volume 2, Chapter 2.
D7. Signed statement: "The estimations in this report were determined using the appropriate estimation model(s) and applied according to the procedures prescribed for the model. To the best of my knowledge these are reasonable estimates using appropriate methods. Documentation is kept on file by the grantee and is available for review by MassDEP/EPA."



Kevin E. McHugh, P.E.
Coneco Engineers & Scientists, Inc.

E. Lessons Learned

Although there is significant interest in reducing levels of pathogens in waterbodies, especially with the new NPDES MS4 permit pending, treatment of pathogens in natural settings is a difficult challenge. References to potential non-structural treatment systems are available but definitive options and expected efficiencies of those options are not readily available due to varied loading and flow rates that can be expected. Additionally, these systems typically require significant land space and therefore are a difficult fit in developed settings.

Because there are significant permitting restrictions associated with treating stormwater within an existing wetland area, non-structural BMPs must be constructed within areas outside of the impacted waterbody which require flow diversion. This poses its own permitting difficulties that must be considered. Adding all of this to the fact that reported pathogen loading does not differentiate between human and animal wastes further complicates the identification of sources that may be causing the detected impairment.

Structural alternatives to treating pathogens in natural water bodies are available (e.g., sand filters, etc.) and these alternatives do provide acceptable reported removal efficiencies. However, these alternatives are typically very costly to install and maintain and diverting water from an aboveground water body to an underground BMP can be challenging and difficult to permit.

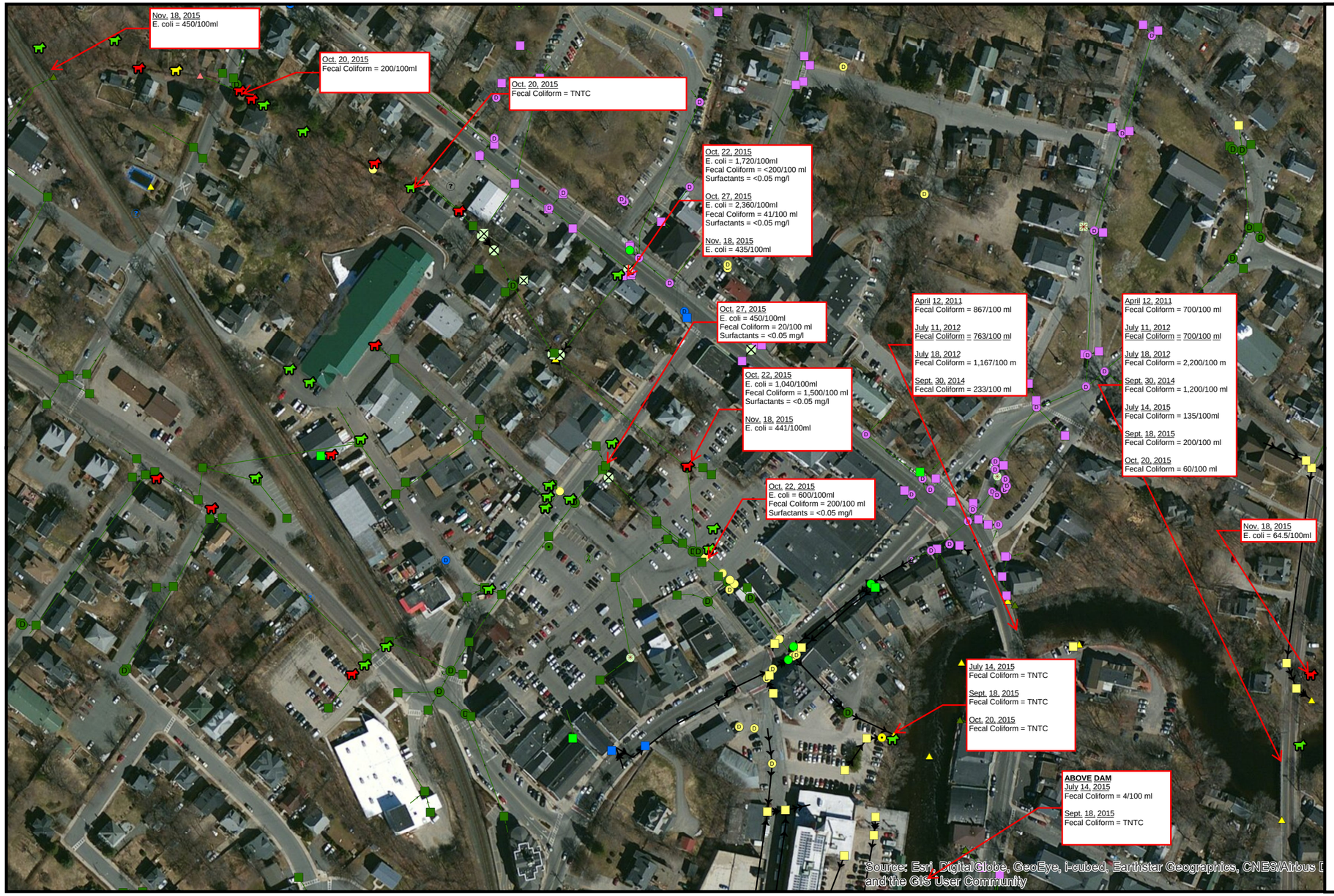
Finally, the “not in my backyard” attitude can restrict the construction of any system that may be perceived to disrupt the current way of life, and this attitude caused the construction of the Farley Brook project to be postponed. Continued and ongoing communication with any and all interested parties is crucial throughout a project and contingencies should be planned to address last minute opponents from derailing a project.

The recommendation for similar future projects is to focus all initial efforts on the identification of potential sources of pathogens prior to investigating treatment options. Source controls should not be considered until sources have been clearly identified. These controls could include select BMPs at discovered outfalls, public education if pet waste is identified as a source, or a combination of structural, non-structural and educational approaches to address varied sources.

F. Attachments

Figure 1 – Monitoring and Canine Detection Results

Appendix A – BMP Design Plans



Drainage by Data Editor

- Unknown

Type, Data_Editor, Data_Origin

- CB, SEA
- MH, SEA
- Node, SEA
- Control, SEA
- CB, CNL
- MH, CNL
- Unk, CNL
- CB, CNO
- MH, CNO
- Unk, CNO
- CB, CONECO
- MH, CONECO
- Unk, CONECO
- CB, NECE
- MH, NECE
- Unk, NECE
- CB, Flyover
- MH, Flyover
- SUB, Flyover
- Unk, Flyover
- CB, HWG 2009
- MH, HWG 2009
- CB, NECE GPS
- MH, NECE GPS
- Meter, NECE GPS
- Unk, NECE GPS

Inlet/Outlet Structure

- Outlet, Unknown (4)

Type, Data Source

- Inlet, NECE (27)
- Outlet, NECE (76)
- Outlet, DOT (8)
- END, SEA (127)

Drainage Pipeline

Source

- Drain Pipe, NECE
- Drain Pipe, SEA
- HWG 2009

Canine Detection

- No
- Yes
- Yes/No

Scale

1 inch = 200 feet

N

0 100 200 Feet

Notes

EXISTING DRAINAGE PLAN

FARLEY BROOK
IPSWICH, MASSACHUSETTS

Sources

Stormwater drainage system and canine detection data provided by Town of Ipswich

CONECO *Engineers & Scientists*

TOWN OF IPSWICH

THIS DOCUMENT IS INTENDED FOR GENERAL PLANNING & INFORMATION PURPOSES ONLY. ALL MEASUREMENTS & LOCATIONS ARE APPROXIMATE.

FIGURE 1

APPENDIX A

Farley Brook Final Draft BMP Plan Set

UTILITY NOTE

THE LOCATION OF ALL UNDERGROUND UTILITIES SHOWN ON THIS PLAN ARE APPROXIMATE ONLY AND ARE BASED UPON A FIELD SURVEY AND A COMPILATION OF AVAILABLE PLANS OF RECORD FROM THE VARIOUS UTILITY COMPANIES. THE INFORMATION PROVIDED IS FOR THE USE OF THE CONTRACTOR. NEITHER WARRANTY NOR GUARANTEE OF THE INFORMATION IS PROVIDED. THE CONTRACTOR SHALL VERIFY THE LOCATIONS OF ALL UTILITIES BY CONTACTING THE RESPECTIVE UTILITY COMPANIES AND "DIG-SAFE" (1-888-344-7233) PRIOR TO CONSTRUCTION.

SEWER ——— S ———

MINERAL STREET

CENTRAL STREET

CONECO

B-122
l=17.26'
18" CMP
GRANITE HEADWALL
l=17.39'
24" OVAL CMP
B-121
B-123
B-120
B-119
B-118
B-117
B-116
B-115
B-114
B-113
B-112
B-111
B-110
B-109
B-108
B-107C, W-18
W-20
W-19
B-107A
B-106
W-1
W-2
W-3
B-107B
W-4
B-107, W-17
W-16
W-5
W-15
W-6
W-14
W-7
W-13
W-12
W-8
W-11
W-9
W-10
l=18.80'
12" HDPE
B-101
l=12.54'
30" CMP
GRANITE HEADWALL
l=12.58'
30" CMP
B-103
B-102
B-105

N/F
ARTHUR E. BAER JR. & SIDERIS D. BAER
MAP 41B LOT 267
0.207 ACRES

N/F
CHRISTINE M. REIF & THOMAS C. KINNARE
MAP 41B LOT 266
0.161 ACRES

N/F
88 CENTRAL STREET CONDOMINIUM
MAP 41B LOT 265
0.245 ACRES

N/F
DOUGLAS M. LAW & JACQUELYN M. LAW
MAP 41B LOT 264
0.187 ACRES

PROPERTY LINE FROM MASS GIS (TYP.)

20' WIDE DRAIN EASEMENT PLAN BOOK 170 PLAN 16

N/F
ALANA M. RATHE & KATE E. RATHE
MAP 41B LOT 268
0.284 ACRES

15' WIDE DRAIN EASEMENT PLAN BOOK 380 PLAN 61

FROM D.P.W. PLAN
SEWER MANHOLE # 33
12" PLUGGED STUB - INV=12.48
8" PLUGGED STUB - INV=12.81
DATUM UNKNOWN

20' ACCESS & UTILITY EASEMENT WITHIN EXISTING SEWER EASEMENT PLAN BOOK 380 PLAN 61 (SEE NOTE 6)

12" A.C. SEWER S=0.005

10' WIDE ACCESS & UTILITY EASEMENT PLAN BOOK 401 PLAN 97

12" A.C. SEWER S=0.005

FARLEY BROOK

20' WIDE SEWER EASEMENT

N/F
84 CENTRAL STREET TRUST
MAP 41B LOT 263
0.185 ACRES

N/F
THOMAS W. BURGESS & JANICE M. BURGESS
MAP 41B LOT 262
0.145 ACRES

N/F
M + B BILO REALTY LLC
MAP 41B LOT 261
0.097 ACRES

N/F
OPEN MEADOW HOMES LLC
MAP 41B LOT 321
0.265 ACRES

N/F
NYLAJO LLC
MAP 41B LOT 326
0.125 ACRES

SEWER & DRAIN EASEMENT PLAN BOOK 170 PLAN 16

N/F
RICHARD & LOUISE LUTTS
MAP 41B LOT 260
0.111 ACRES

25 FT. WETLAND BUFFER

50 FT. WETLAND BUFFER

100 FT. RIVERFRONT BUFFER

N/F
LOUIS J. GALANIS & E. LORAYNE TSOUTSOURAS
MAP 41B LOT 283
0.399 ACRES

EDGE PAVEMENT

CONCRETE RETAINING WALL

100 FT. WETLAND BUFFER

N/F
MARJORIE W. LEE
MAP 41B LOT 269
0.206 ACRES

N/F
PETER M. ADAMOWICZ
MAP 41B LOT 270
0.406 ACRES

N/F
RICHARD P. O'BRIEN & TRACY L. O'BRIEN
MAP 41B LOT 271
0.344 ACRES

200 FT. RIVERFRONT BUFFER

N/F
DSM PROPERTY MANAGEMENT INC.
MAP 41B LOT 272
0.585 ACRES

N/F
SOFFRON HOLDINGS LLC
MAP 41B LOT 281
1.43 ACRES

SOFFRON LANE

20' 0 20' 40'
SCALE IN FEET

NOTES:

1. VERTICAL DATUM: NGVD 29
2. WETLANDS WERE DELINEATED ON JULY 16, 2015 BY LEC ENVIRONMENTAL CONSULTANTS, INC.
3. ON-THE-GROUND SURVEY WAS COMPLETED BY CONECO ENGINEERS AND SCIENTISTS ON AUGUST 2, 2015.
4. PROPERTY LINES WERE IMPORTED FROM MASSGIS DATABASE.
5. PROPERTY OWNER AND LOT INFORMATION WAS TAKEN FROM THE IPSWICH ASSESSOR'S ONLINE DATABASE AT IPSWICH.PATRIOTPROPERTIES.COM.
6. EASEMENT LAYOUT AND PLAN BOOK/PAGE INFORMATION WAS DIGITIZED FROM A PLAN TITLED "PLAN OF LAND IN IPSWICH, MA" PROPERTY OF NYLAJO, DATED OCTOBER 9, 2008. PLAN WAS DRAWN BY DONOHOE AND PARKHURST, INC.

REVISIONS

NO.	DATE	DESCRIPTION	DR/CK

PREPARED FOR:
TOWN OF IPSWICH DEPARTMENT OF PUBLIC WORKS
25 GREEN STREET
IPSWICH, MA 01938

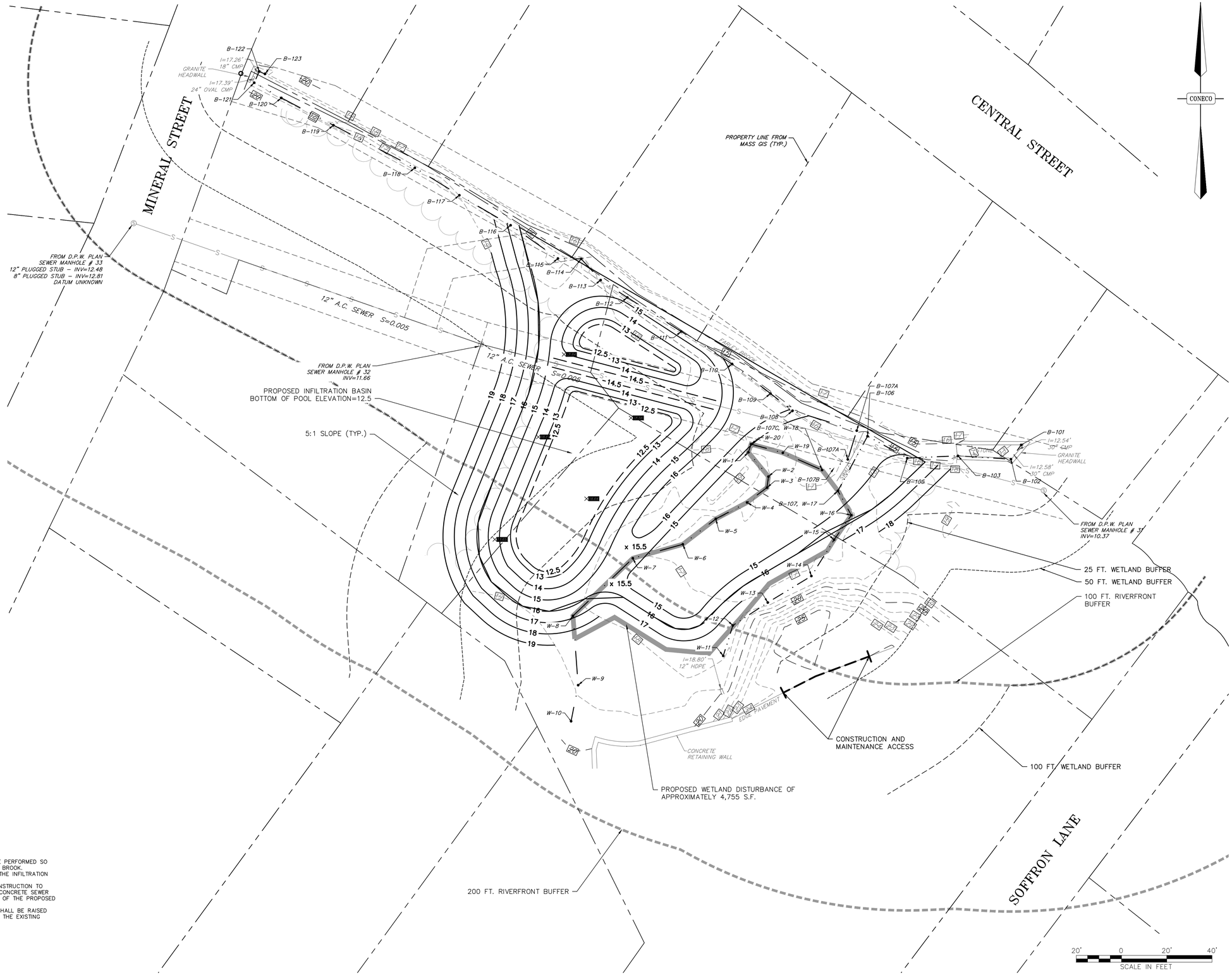
DRAWING:
EXISTING CONDITIONS PLAN

PROJECT:
IPSWICH RIVER WATERSHED BMP IMPLEMENTATION AT FARLEY BROOK
NOTICE OF INTENT PLANS
IPSWICH, MA 01938

PLAN SET:
FLOOD MITIGATION PROJECT

CONECO
Engineers & Scientists
4 FIRST STREET, BRIDGEWATER, MASSACHUSETTS 02324
PHONE 508-697-3191 OR 800-548-3355 FAX 508-697-5996
WEBSITE: www.coneco.com

DATE	6/7/2017
DESIGNED: DAH	CHECKED: TSB
DRAFTED: DAH	IN CHARGE: KEM
SCALE:	1"=20'
PROJECT NO.	8588.0
SHEET NO.	1



NOTES:

1. GRADING OF THE STREAM BANKS SHALL BE PERFORMED SO THAT THE BASE FLOW WILL REMAIN IN THE BROOK. STORMWATER RUNOFF SHALL ONLY ENTER THE INFILTRATION BASIN DURING STORM EVENTS.
2. CONTRACTOR SHALL USE CARE DURING CONSTRUCTION TO AVOID DAMAGING THE EXISTING ASBESTOS CONCRETE SEWER LINE WHICH PASSES THROUGH THE CENTER OF THE PROPOSED INFILTRATION BASIN.
3. THE BOTTOM OF THE INFILTRATION BASIN SHALL BE RAISED TO APPROXIMATELY ELEVATION 14.5 ABOVE THE EXISTING SEWER LINE.

REVISIONS

NO.	DATE	DESCRIPTION	DR/CK
1	7/7/17	ADJUST GRADES/MOUND BOTTOM OF INFILTRATION BASIN ABOVE SEWER LINE	DAH/KEM

PREPARED FOR:
TOWN OF IPSWICH DEPARTMENT OF PUBLIC WORKS
25 GREEN STREET
IPSWICH, MA 01938

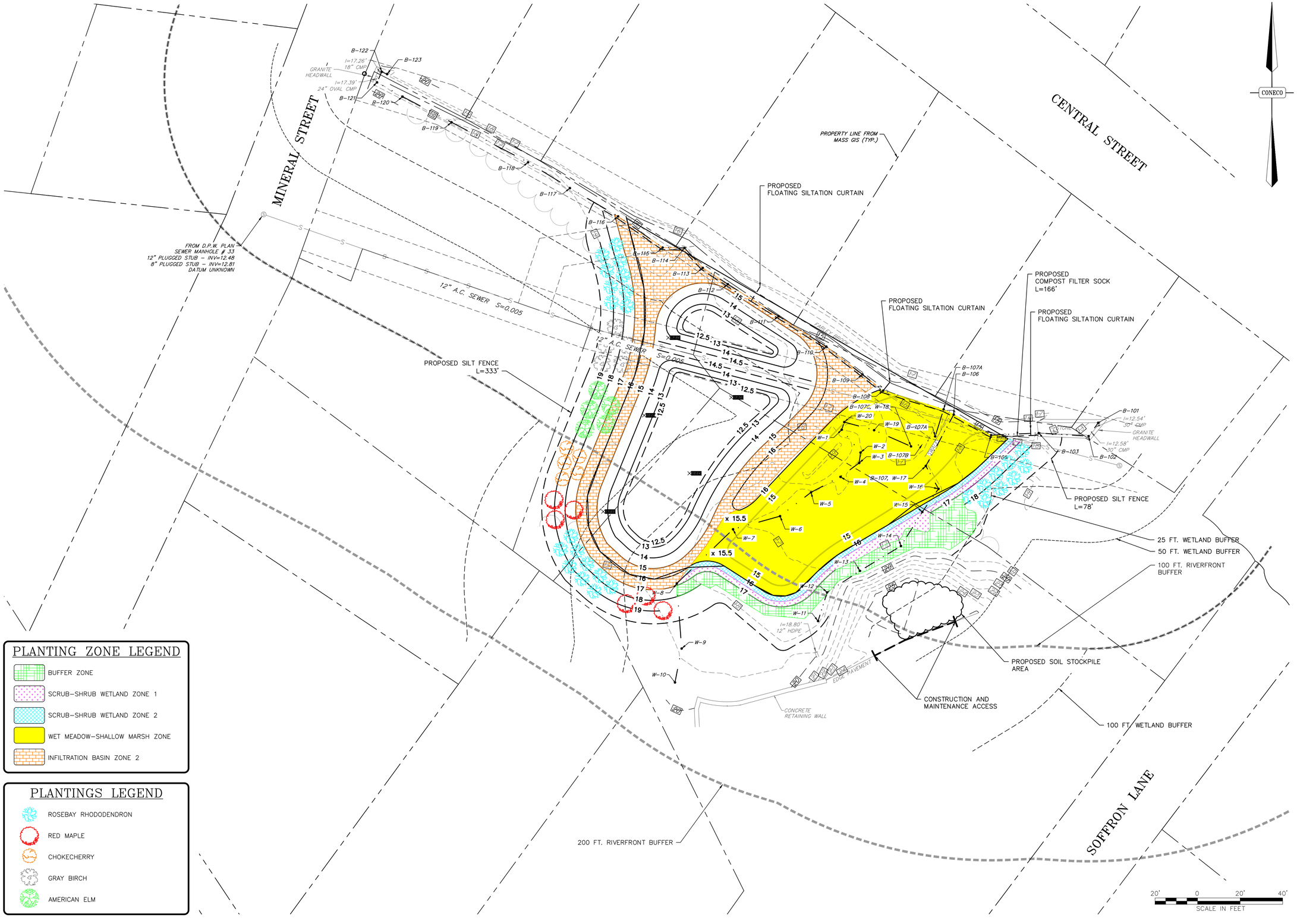
DRAWING:
GRADING, DRAINAGE, AND EROSION CRONTROL PLAN

PROJECT:
IPSWICH RIVER WATERSHED BMP IMPLEMENTATION AT FARLEY BROOK
NOTICE OF INTENT PLANS
IPSWICH, MA 01938

PLAN SET:
FLOOD MITIGATION PROJECT

CONECO
Engineers & Scientists
4 FIRST STREET, BRIDGEWATER, MASSACHUSETTS 02324
PHONE 508-697-3191 OR 800-548-3355 FAX 508-697-5996
WEBSITE: www.coneco.com

DATE	6/7/2017
DESIGNED: DAH	CHECKED: KEM
DRAFTED: DAH	IN CHARGE: KEM
SCALE:	1"=20'
PROJECT NO.	8588.0
SHEET NO.	2



PLANTING ZONE LEGEND

- BUFFER ZONE
- SCRUB–SHRUB WETLAND ZONE 1
- SCRUB–SHRUB WETLAND ZONE 2
- WET MEADOW–SHALLOW MARSH ZONE
- INFILTRATION BASIN ZONE 2

PLANTINGS LEGEND

- ROSEBAY RHODODENDRON
- RED MAPLE
- CHOKECHERRY
- GRAY BIRCH
- AMERICAN ELM

REVISIONS

NO.	DATE	DESCRIPTION	DR/CK
1	7/7/17	ADJUST GRADES/MOUND BOTTOM OF INFILTRATION BASIN ABOVE SEWER LINE	DAH/KEM

PREPARED FOR:
TOWN OF IPSWICH DEPARTMENT OF PUBLIC WORKS
25 GREEN STREET
IPSWICH, MA 01938

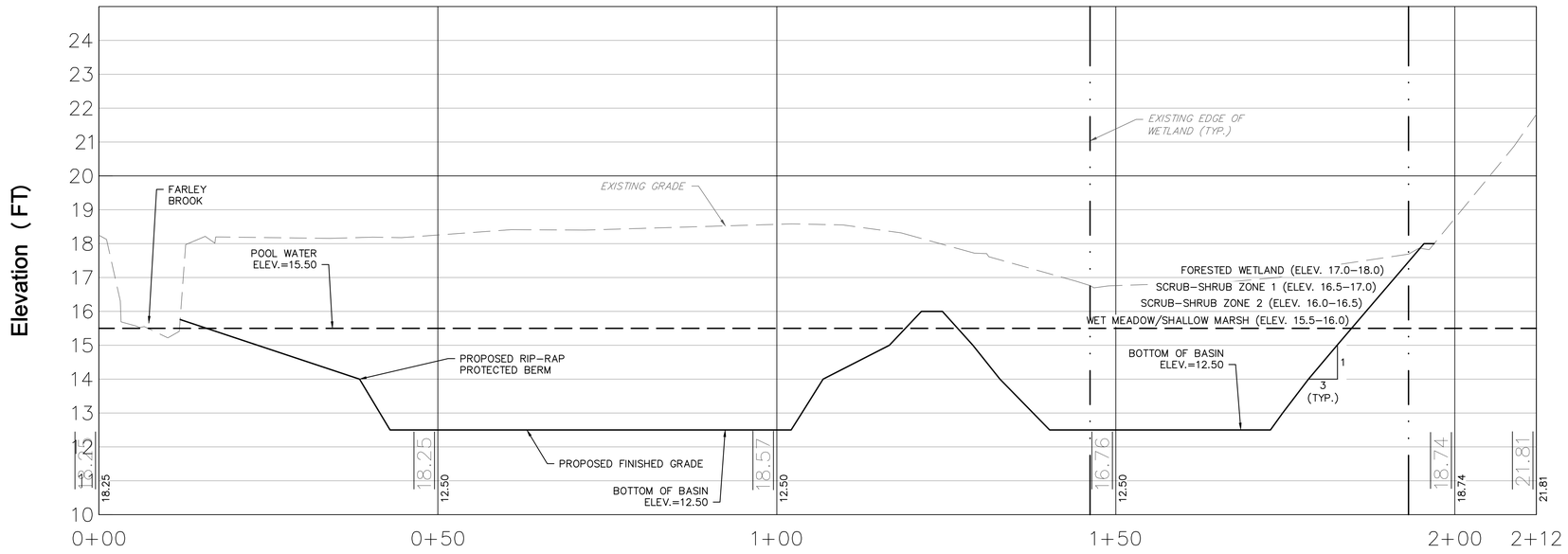
DRAWING:
PLANTING PLAN

PROJECT:
IPSWICH RIVER WATERSHED BMP IMPLEMENTATION AT FARLEY BROOK
NOTICE OF INTENT PLANS
IPSWICH, MA 01938

PLAN SET:
FLOOD MITIGATION PROJECT

CONECO
Engineers & Scientists
4 FIRST STREET, BRIDGEWATER, MASSACHUSETTS 02324
PHONE 508-697-3191 OR 800-548-3355; FAX 508-697-5996
WEBSITE: www.coneco.com

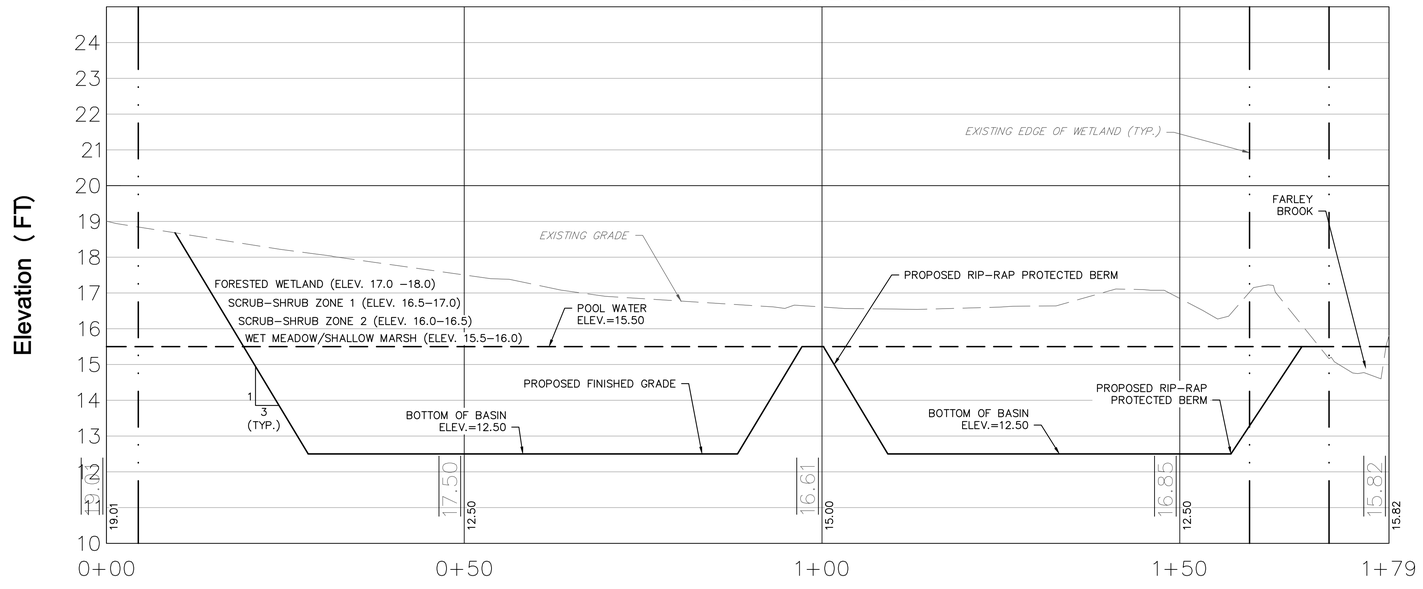
DATE	6/7/2017
DESIGNED: DAH	CHECKED: KEM
DRAFTED: DAH	IN CHARGE: KEM
SCALE:	1"=20'
PROJECT NO.	8588.0
SHEET NO.	3



CROSS SECTION A-A

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=2'

SECTION A-A
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



CROSS SECTION B-B

HORIZONTAL SCALE: 1"=10'
VERTICAL SCALE: 1"=2'

REVISIONS

NO.	DATE	DESCRIPTION	DR/CK

PREPARED FOR:
TOWN OF IPSWICH DEPARTMENT OF PUBLIC WORKS
25 GREEN STREET
IPSWICH, MA 01938

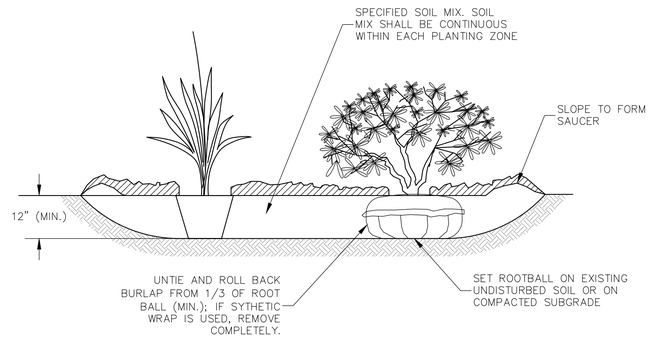
DRAWING:
CROSS SECTION PLANS

PROJECT:
IPSWICH RIVER WATERSHED BMP IMPLEMENTATION AT FARLEY BROOK
NOTICE OF INTENT PLANS
IPSWICH, MA 01938

PLAN SET:
FLOOD MITIGATION PROJECT

CONECO
Engineers & Scientists
4 FIRST STREET, BRIDGEWATER, MASSACHUSETTS 02324
PHONE 508-697-3191 OR 800-548-3355; FAX 508-697-5996
WEBSITE: www.coneco.com

DATE	6/7/2017
DESIGNED: DJD	CHECKED: KEM
DRAFTED: DJD	IN CHARGE: KEM
SCALE:	AS NOTED
PROJECT NO.	8588.0
SHEET NO.	4



NOTE: LOOSEN ROOTS AT THE OUTER EDGE OF ROOTBALL OF CONTAINER GROWN SHRUBS & TREES

WETLAND SHRUB & TREE PLANTING

N.T.S.

WETLAND AND INFILTRATION BASIN PLANTING SCHEDULE

WETLAND BUFFER ZONE PLANTING ZONE (ELEV. 17.0'–18.0') 1,554 S.F.					
QTY.	COMMON NAME	LATIN NAME	APPROXIMATE SIZE	SPACING	SYMBOL
TBD	RED MAPLE	*ACER RUBRUM*	3–4 FT. MIN.	10' OC	
TBD	BLACK GUM	*NYSSA SYLVATICA*	3–4 FT. MIN.	10' OC	
TBD	YELLOW BIRCH	*BETULA ALLEGHANIENSIS*	3–4 FT. MIN.	10' OC	
TBD	GRAY BIRCH	*BETULA POPULIFOLIA*	3–4 FT. MIN.	10' OC	
TBD	COTTONWOOD	*POPULUS DELTOIDES*	3–4 FT. MIN.	10' OC	
TBD	TOTAL				
SEE NOTE 2 FOR SEED MIX					

SCRUB–SHRUB WETLAND PLANTING ZONE 1 (ELEV. 16.5'–17.0') 609 S.F.					
QTY.	COMMON NAME	LATIN NAME	APPROXIMATE SIZE	SPACING	SYMBOL
TBD	REDOSIER DOGWOOD	*CORNUS SERICEA*	3–4 FT. MIN.	6' OC	
TBD	NORTHERN ARROWWOOD	*VIBURNUM DENTATUM*	3–4 FT. MIN.	6' OC	
TBD	SILKY DOGWOOD	*CORNUS AMOMUM*	3–4 FT. MIN.	6' OC	
TBD	RED CHOKEBERRY	*ARONIA ARBUTIFOLIA*	3–4 FT. MIN.	6' OC	
TBD	TOTAL				
SEE NOTE 2 FOR SEED MIX					

SCRUB–SHRUB WETLAND PLANTING ZONE 2 (ELEV. 16.0'–16.5') 458 S.F.					
QTY.	COMMON NAME	LATIN NAME	APPROXIMATE SIZE	SPACING	SYMBOL
TBD	SPECKLED ALDER	*ALNUS INCANA*	3–4 FT. MIN.	6' OC	
TBD	SAND BAR WILLOW	*SALIX EXIGUA*	3–4 FT. MIN.	6' OC	
TBD	BEB'S WILLOW	*SALIX BEBBIANA*	3–4 FT. MIN.	6' OC	
TBD	TOTAL				
SEE NOTE 2 FOR SEED MIX					

WET MEADOW–SHALLOW MARSH PLANTING ZONE (ELEV. 15.0'–16.0') 6,403 S.F.					
QTY.	COMMON NAME	LATIN NAME	APPROXIMATE SIZE	SPACING	SYMBOL
TBD	BEARDED SEDGE	*CAREX COMOSA*	2" PLUGS	1' OC, CLUSTERED	
TBD	TUSSOCK SEDGE	*CAREX STRICTA*	2" PLUGS	1' OC, CLUSTERED	
TBD	THREE–WAY SEDGE	*DULICHIUM ARUNDINACEUM*	2" PLUGS	1' OC, CLUSTERED	
TBD	FOWL MANNA GRASS	*GLYCERIA STRIATA*	2" PLUGS	1' OC, CLUSTERED	
TBD	SOFT RUSH	*JUNCUS EFFUSES*	2" PLUGS	1' OC, CLUSTERED	
TBD	ARROW ARUM	*PELTANDRA VIGNICA*	2" PLUGS	1' OC, CLUSTERED	
TBD	PICKERELWEED	*PONTEDARIA CORDATA*	2" PLUGS	1' OC, CLUSTERED	
TBD	NORTHERN ARROWHEAD	*SAGITTARIA LATIFOLIA*	2" PLUGS	1' OC, CLUSTERED	
TBD	GREEN BULRUSH	*SCIRPUS ATROVIRENS*	2" PLUGS	1' OC, CLUSTERED	
TBD	HARD–STEM BULRUSH	*SCHOENOPLECTUS ACUTUS*	2" PLUGS	1' OC, CLUSTERED	
TBD	WOOLGRASS	*SCIRPUS CYPERINUS*	2" PLUGS	1' OC, CLUSTERED	
TBD	BURREED	*SPARGANIUM AMERICANUM*	2" PLUGS	1' OC, CLUSTERED	
TBD	TOTAL				
SEE NOTE 2 FOR SEED MIX					

BASIN BUFFER ZONE PLANTING ZONE 1 (ELEV. 17.0'–19.0') 2,748 S.F.					
QTY.	COMMON NAME	LATIN NAME	APPROXIMATE SIZE	SPACING	SYMBOL
6	RED MAPLE	*ACER RUBRUM*	3–4 FT. MIN.	10' OC	
3	AMERICAN ELM	*ULMUS AMERICANA*	3–4 FT. MIN.	10' OC	
5	GRAY BIRCH	*BETULA POPULIFOLIA*	3–4 FT. MIN.	10' OC	
5	CHOKECHERRY	*PRUNUS VIRGINIANA*	3–4 FT. MIN.	6' OC	
27	ROSEBAY RHODODENDRON	*RHODODENDRON MAXIMUM*	3–4 FT. MIN.	6' OC	
46	TOTAL				
SEE NOTE 3 FOR SEED MIX					

BASIN BUFFER ZONE PLANTING ZONE 2 (ELEV. 15.0'–17.0') 4,310 S.F.					
QTY.	COMMON NAME	LATIN NAME	APPROXIMATE SIZE	SPACING	SYMBOL
TBD	NANNYBERRY	*VIBURNUM LENTAGO*	3–4 FT. MIN.	6' OC	
TBD	SWEET PEPPERBUSH	*CLETHRA ALNIFOLIA*	3–4 FT. MIN.	6' OC	
TBD	GRAY DOGWOOD	*CORNUS RACEMOSA*	3–4 FT. MIN.	6' OC	
TBD	BLACK CHOKEBERRY	*ARONIA MELANOCARPA*	3–4 FT. MIN.	6' OC	
TBD	SHADBLOW/SERVICEBERRY	*AMELANCHIER CANADENSIS/ARBOREA*	3–4 FT. MIN.	6' OC	
TBD	TOTAL				
SEE NOTE 3 FOR SEED MIX					

PLANTING SCHEDULE NOTES:

1. PLANTING SCHEDULE DESIGN WAS PERFORMED BY LEC ENVIRONMENTAL.
2. WETLAND SEED MIX – PA NEW ENGLAND PROVINCE FacW MIX, ERNST CONSERVATION SEEDS, INC., (800) 873–3321 (OR EQUIVALENT) AT AN APPLICATION RATE OF 20 LBS PER ACRE OR HIGHER IF APPLIED AT THE END OF THE GROWING SEASON.
3. INFILTRATION BASIN SEED MIXES:
   A. ELEVATIONS 12.5' TO 15.0' NEW ENGLAND EROSION CONTROL/RESTORATION MIX FOR DETENTION BASINS AND MOIST SITES (OR EQUIVALENT). AVAILABLE THROUGH NEW ENGLAND WETLAND PLANTS, INC. AMHERST, MA, (413) 548–8000.
   B. ELEVATIONS 15.0' TO 19.0' NEW ENGLAND CONSERVATION/WILDLIFE MIX (OR EQUIVALENT). AVAILABLE THROUGH NEW ENGLAND WETLAND PLANTS, INC. AMHERST, MA, (413) 548–8000.
4. WET MEADOW–SHALLOW MARSH PLANTING ZONE PLANT QUANTITIES ARE BASED ON PURCHASING FLATS OF 50.
5. WITH PERMISSION FROM WETLAND SCIENTIST, QUANTITIES OF EACH SPECIES MAY BE MODIFIED SLIGHTLY AS LONG AS TOTAL NUMBER OF PLANTS ARE ACHIEVED.

LEGEND:

TBD = TO BE DETERMINED
OC = ON CENTER

DRAFT

REVISIONS

NO.	DATE	DESCRIPTION	DR/CK

PREPARED FOR: TOWN OF IPSWICH DEPARTMENT OF PUBLIC WORKS 25 GREEN STREET IPSWICH, MA 01938

DRAWING: DETAILS SHEET 1 OF 2

PROJECT: IPSWICH RIVER WATERSHED BMP IMPLEMENTATION AT FARLEY BROOK NOTICE OF INTENT PLANS IPSWICH, MA 01938

PLAN SET: FLOOD MITIGATION PROJECT

CONECO Engineers & Scientists
4 FIRST STREET, BRIDGEWATER, MASSACHUSETTS 02324
PHONE 508-697-3191 OR 800-548-3350; FAX 508-697-5996
WEBSITE: www.coneco.com

DATE	6/7/2017
DESIGNED: DJD	CHECKED: KEM
DRAFTED: DJD	IN CHARGE: KEM
SCALE:	N.T.S.
PROJECT NO.	8588.0
SHEET NO.	5